

# ACE-FTS Instrument on-board SCISAT-1: Atmospheric Chemistry Experiment (ACE)

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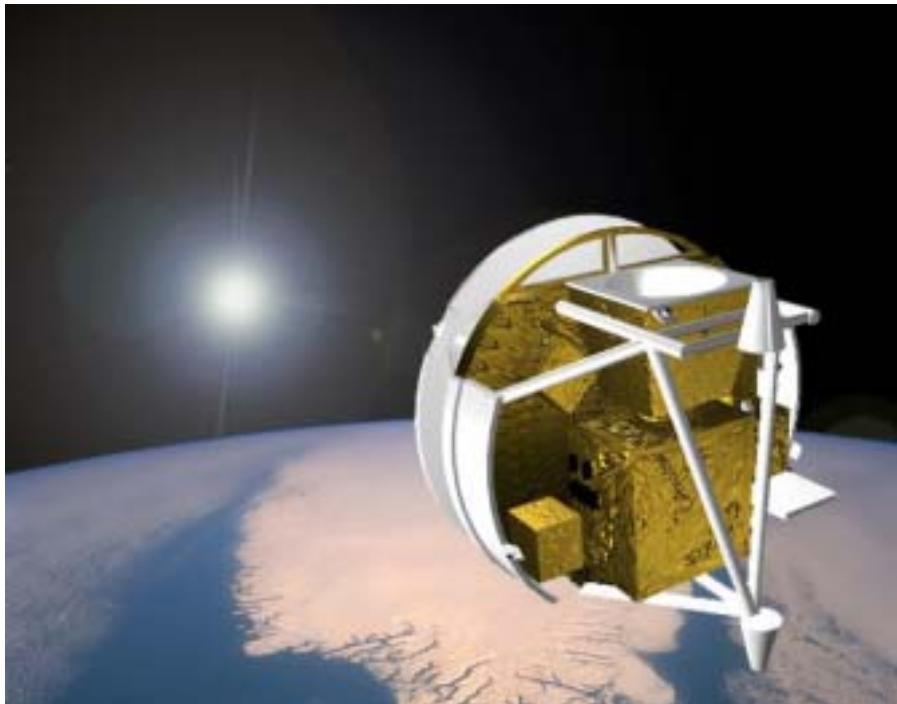
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Ray Nassar, Randall Skelton and Peter F. Bernath  
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Cora Randall

Laboratory for Atmospheric and Space Physics,  
University of Colorado



# SCISAT-1



Size: 1.12 m dia. x 1 m  
Total mass: 152 kg  
Total power: 70 W  
(from single solar panel)

Launch date: August 12, 2003  
Launch vehicle: Pegasus XL  
(provided by NASA)

Orbit: 74° inclined circular orbit  
at 650 km



# Instruments

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## ACE-FTS:

- a high resolution ( $0.02\text{ cm}^{-1}$ ) infrared Fourier transform spectrometer operating between 2-13 microns
- 2-channel visible/near infrared imager operating at 0.525 and 1.02 microns

## MAESTRO:

- dual UV / Visible / NIR spectrometer measuring from 0.285 to 1.030 microns, resolution  $\sim 1\text{-}2\text{ nm}$

**Measurement modes:** solar occultation, nadir (ACE-FTS) and backscatter (MAESTRO), calibration (sunscans)

**Instrument Pointing:** suntracker located within ACE-FTS



# Baseline ACE Measurements

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- **ACE-FTS:** O<sub>3</sub>, CH<sub>4</sub>, H<sub>2</sub>O, NO, NO<sub>2</sub>, ClNO<sub>3</sub>, HNO<sub>3</sub>, N<sub>2</sub>O, N<sub>2</sub>O<sub>5</sub>, HCl, CCl<sub>3</sub>F (F11), CCl<sub>2</sub>F<sub>2</sub> (F12), HF, CO, temperature and pressure (from CO<sub>2</sub>)  
**ACE-FTS Imagers:** atmospheric extinction
  - vertical resolution ~ 3-4 km (for both FTS and imagers)
- **MAESTRO:** O<sub>3</sub>, NO<sub>2</sub>, atmospheric extinction, [temperature and pressure (from O<sub>2</sub> A-, B- and  $\gamma$ -bands)]
  - vertical resolution ~1-2 km

Altitude range for retrieved results ~ 10-50 km (max. 100 km)



# ACE-FTS (ABB)

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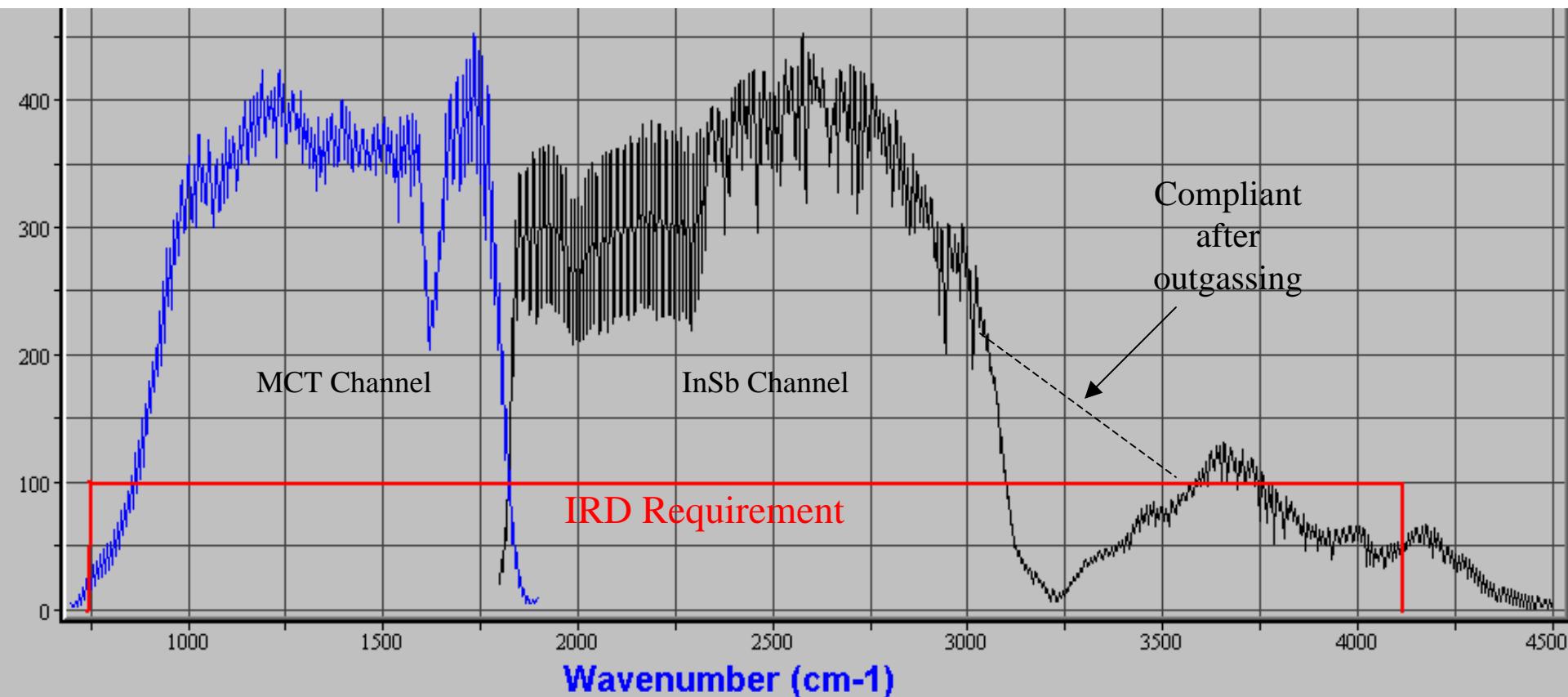
# Post-launch Activities

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- Bus and Instrument Commissioning
  - Completed in December 2003
- Science Hardware Commissioning
  - Verifying performance and operating parameters, exercising secondary measurement modes, calibration measurements (co-registration sunscans)
- Science Software Testing
  - Picked 3 occultations as test cases (Jan. 12-Antarctic, Feb. 2-tropics, Feb. 21-Arctic) and processed “by hand”
  - Automation of software level 0-1(done) and 1-2 (to be finished by end of month)
- Routine Science Operations – started in February

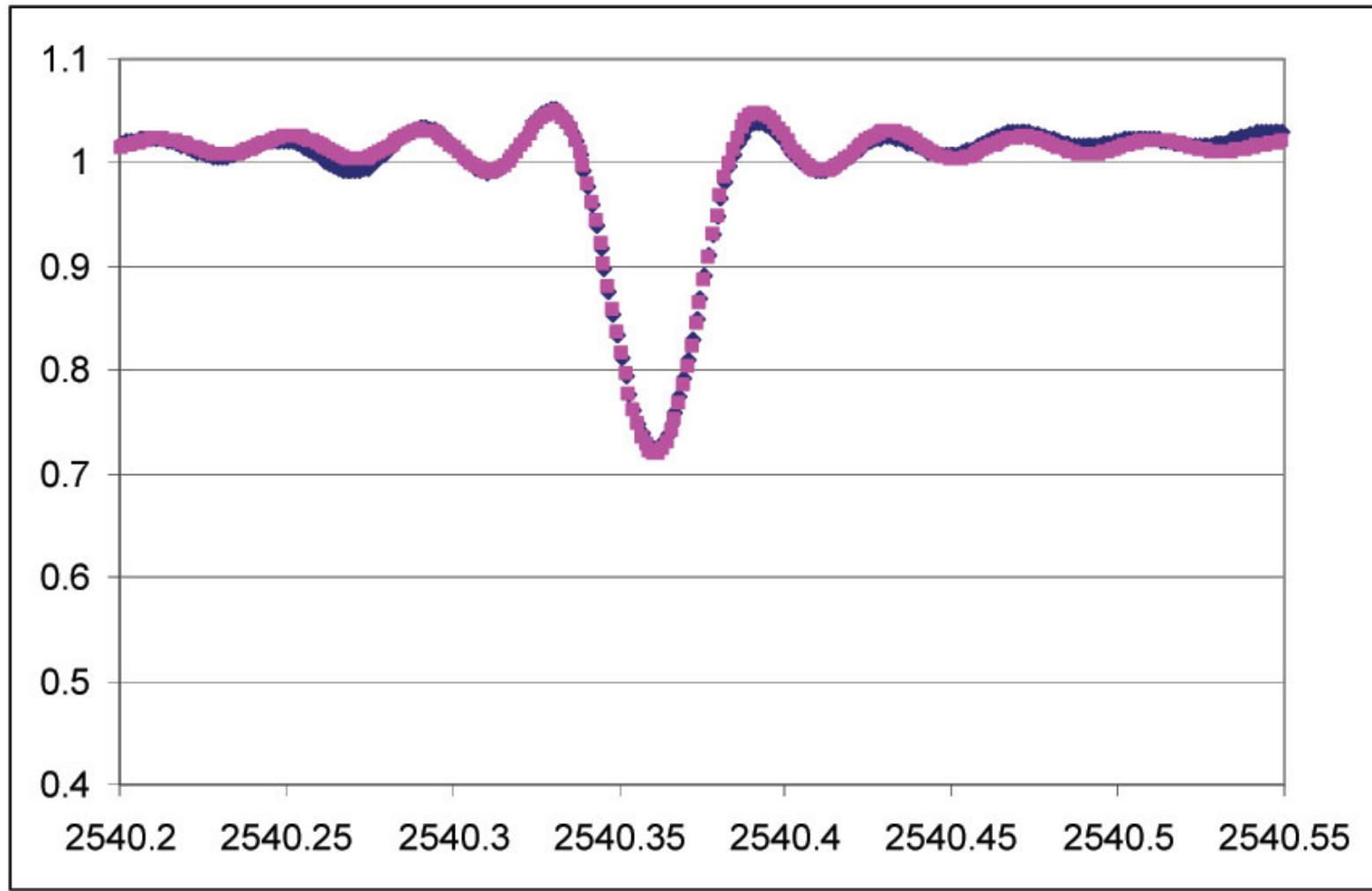


# Excellent SNR Performance



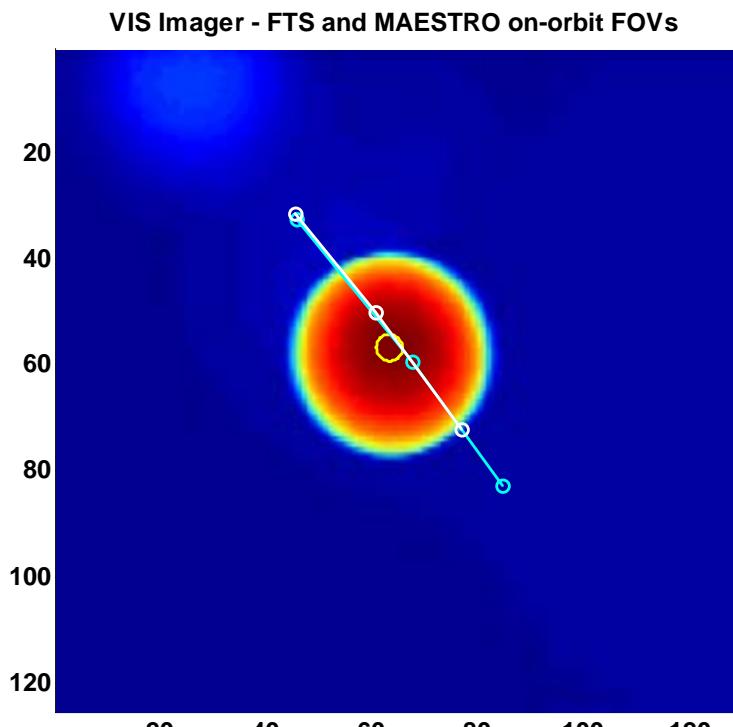
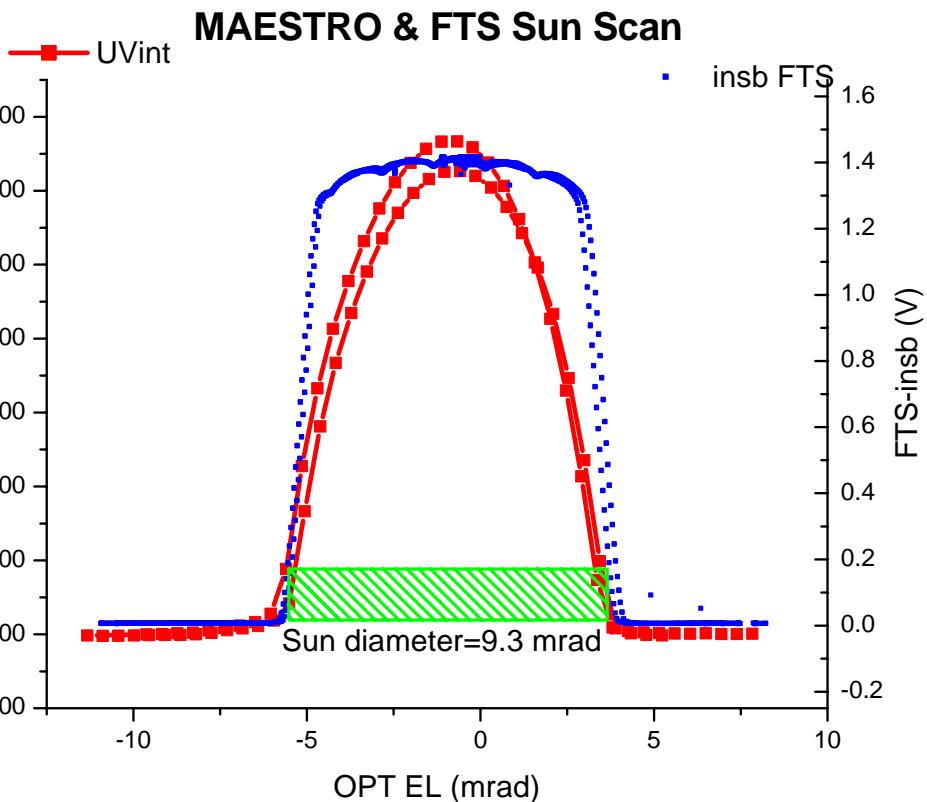


# FTS Lineshape (Atm. N<sub>2</sub>O)





# On-orbit Co-registration

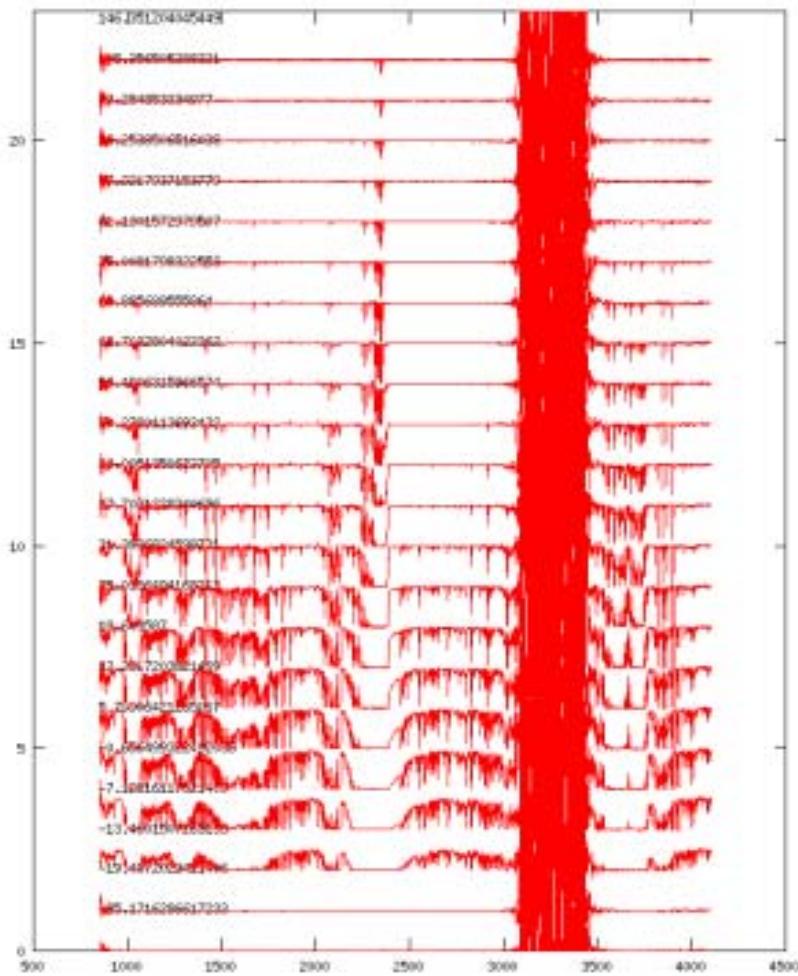


Results of sunscan calibrations show that slight adjustment in azimuth is required to better centre the MAESTRO slits on the Sun.

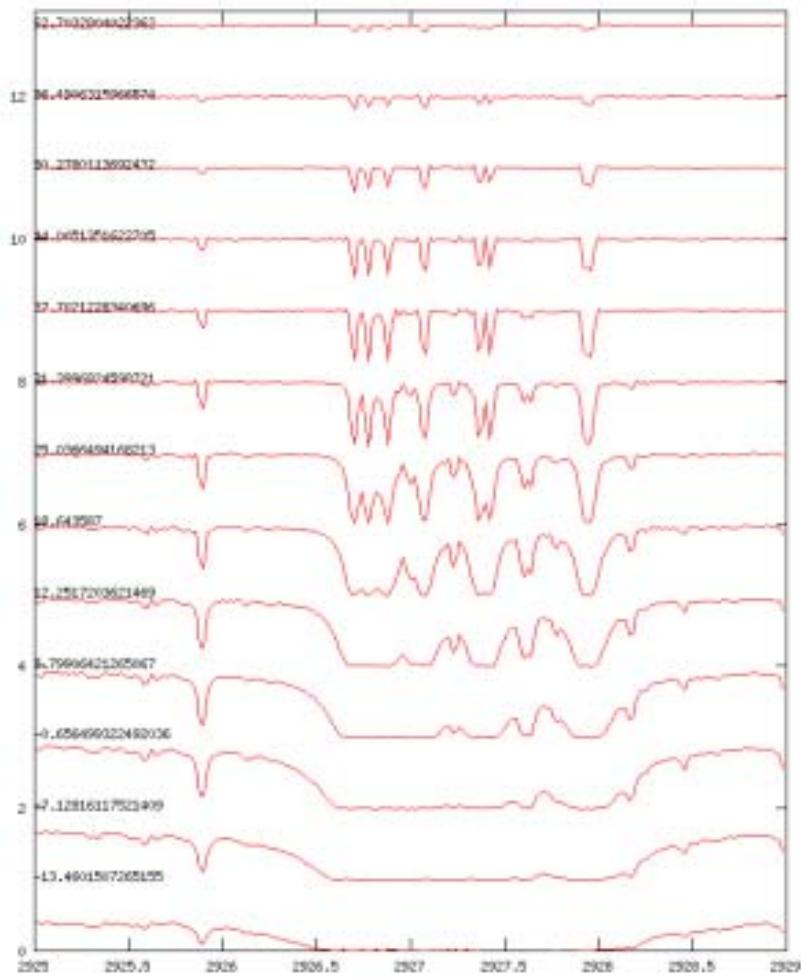


# Occultation sequence

Jan. 12, 2004 9:50:23 (UTC)



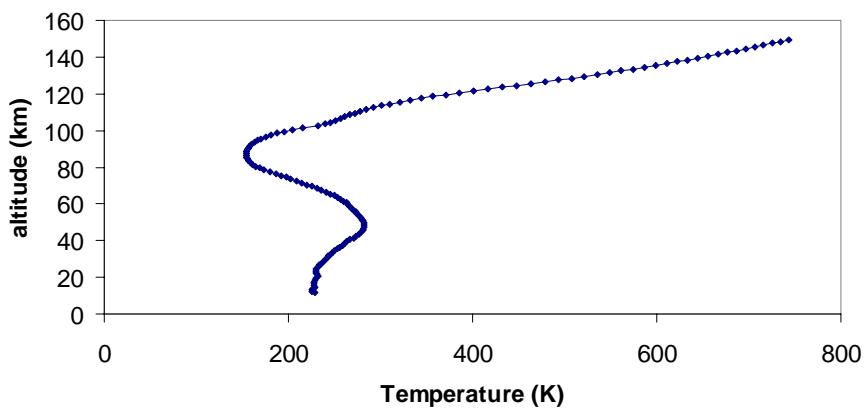
HCl R(0) and CH<sub>4</sub> P(9) lines



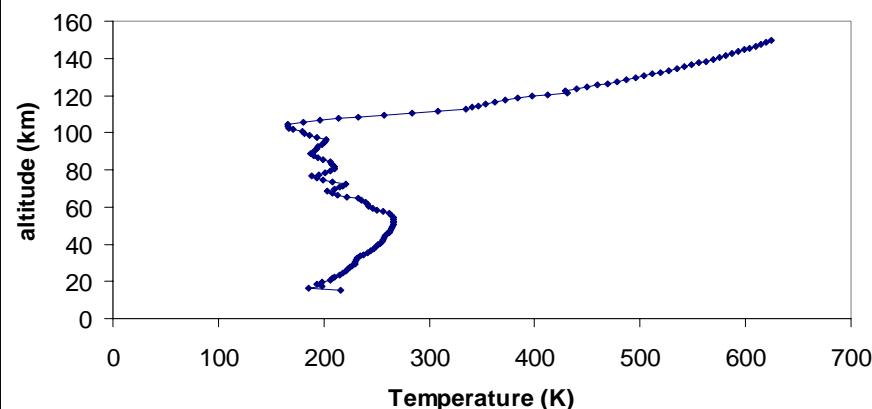


# Temperature Retrievals

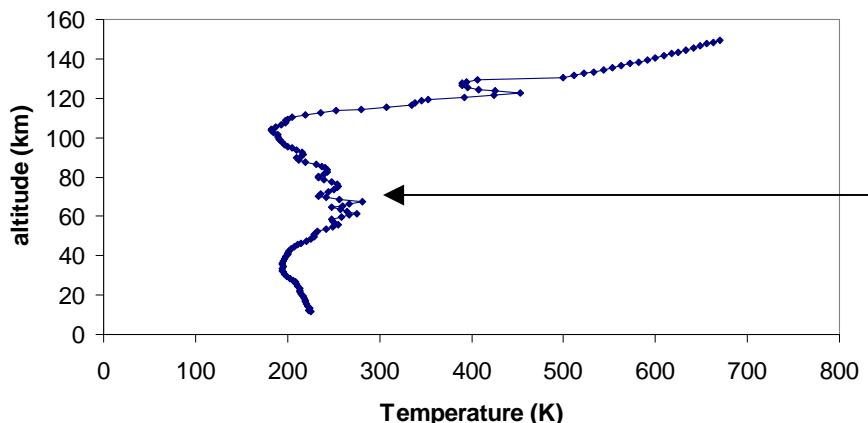
Jan 12 Retrieved Temperature



Feb 2 Retrieved T



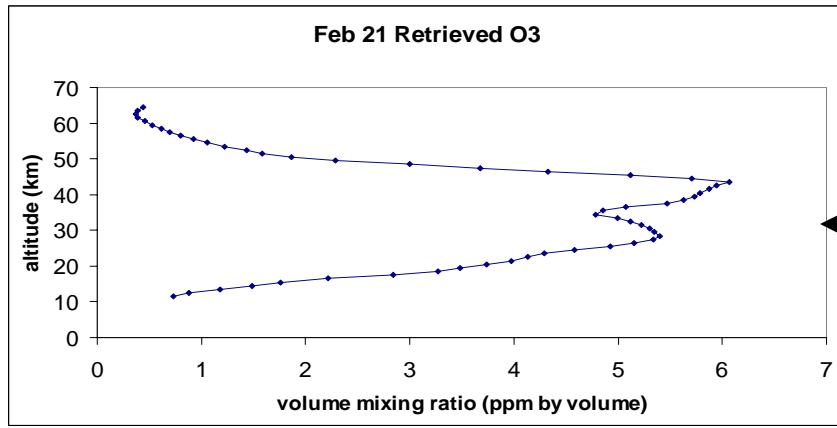
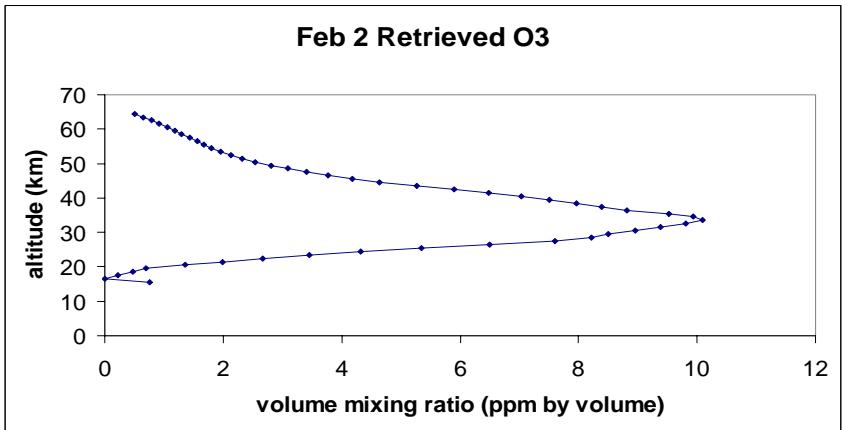
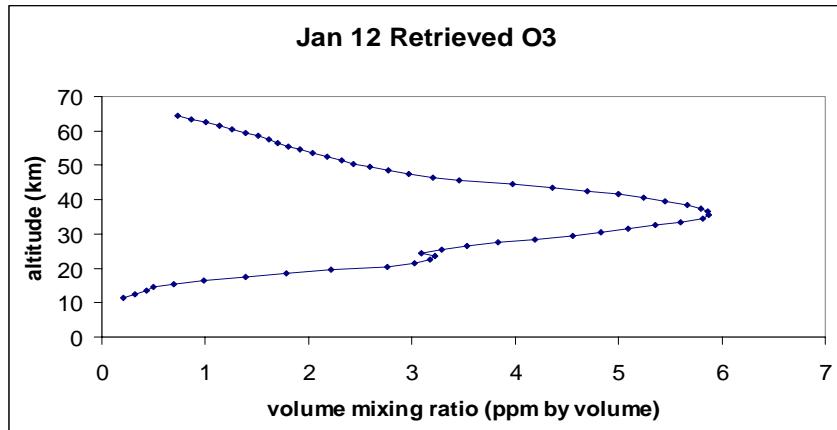
Feb 21 Retrieved T



Interesting effects in this region (late February in the Arctic) make for difficult fitting. There are likely variations along the horizontal



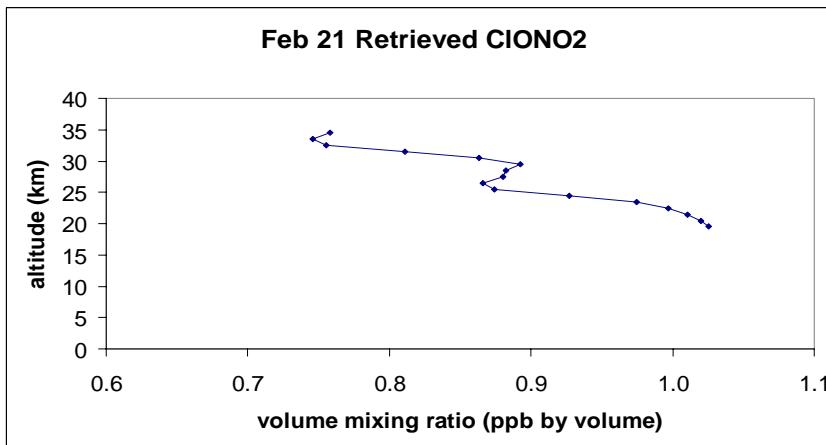
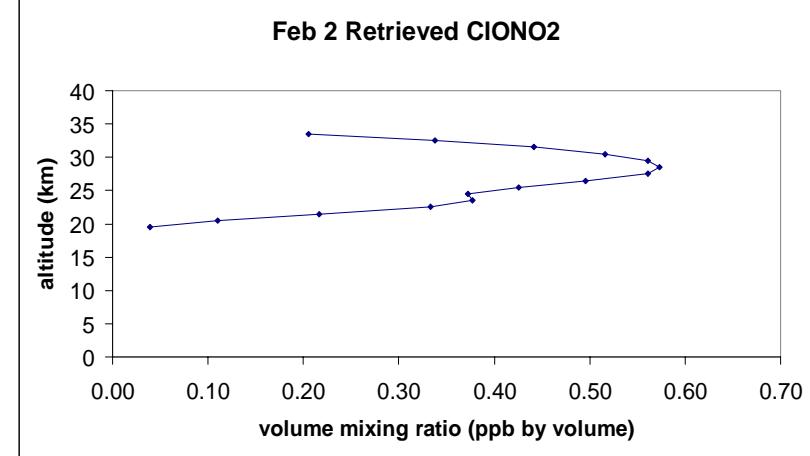
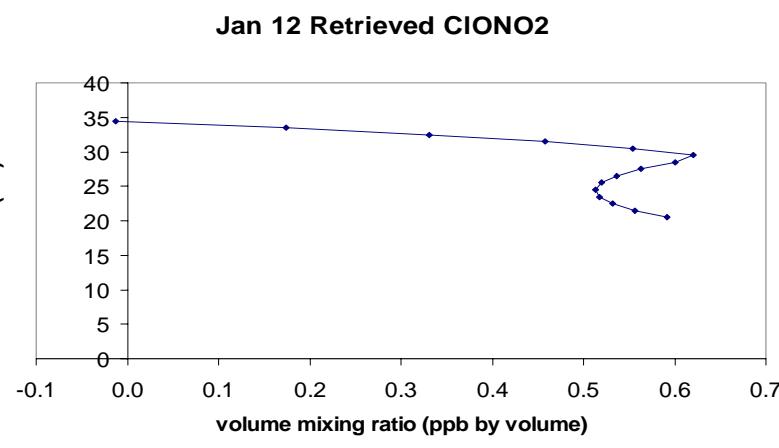
# O<sub>3</sub>



Consistent with an ozone depletion event (late February in the Arctic)



# CIONO<sub>2</sub>



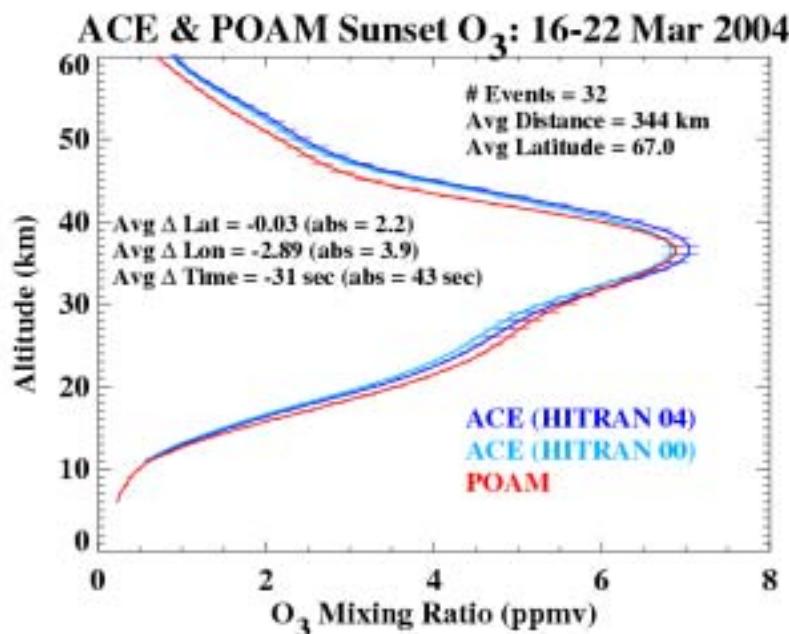
Using measured cross sections from DLR

1300 cm<sup>-1</sup> band used for these retrievals

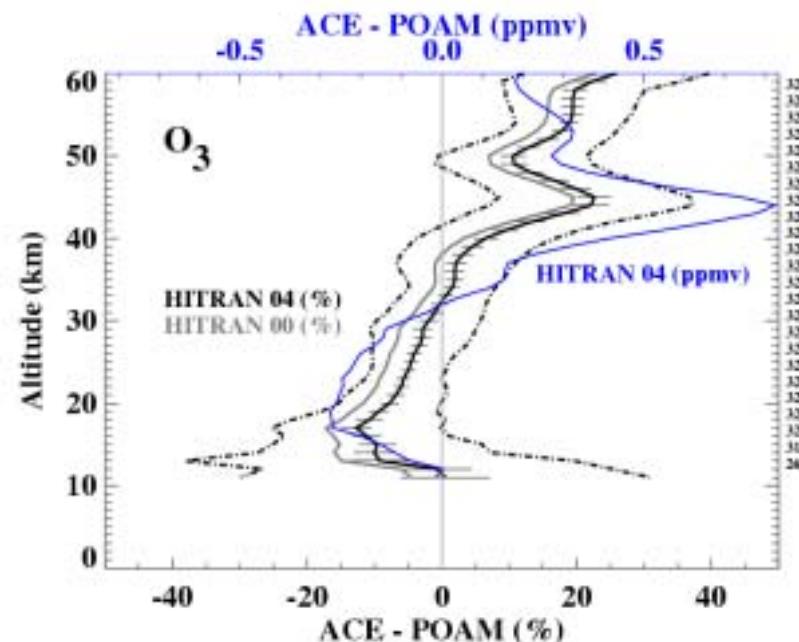
# Comparisons between ACE-FTS and POAM III Ozone

32 local sunset coincidences from 16-22 March near 67°N

## Average Profiles



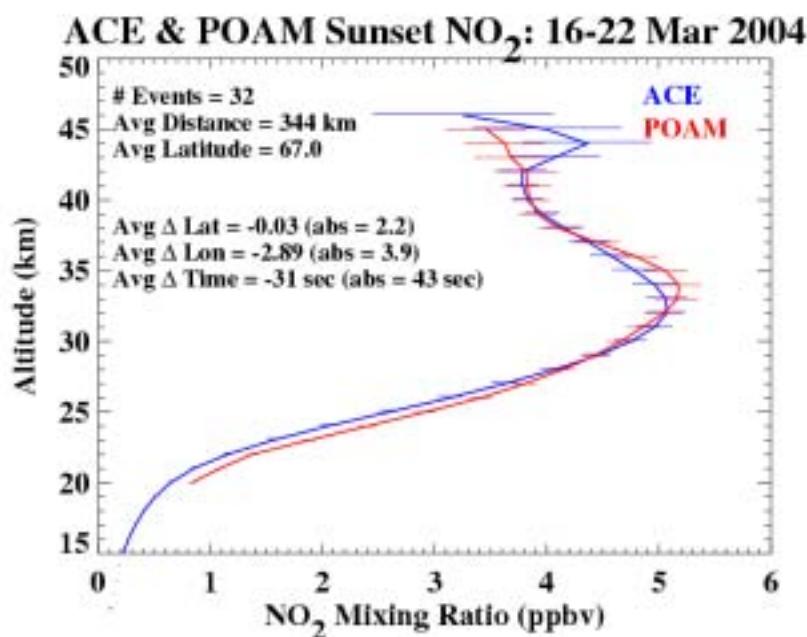
## Average Differences



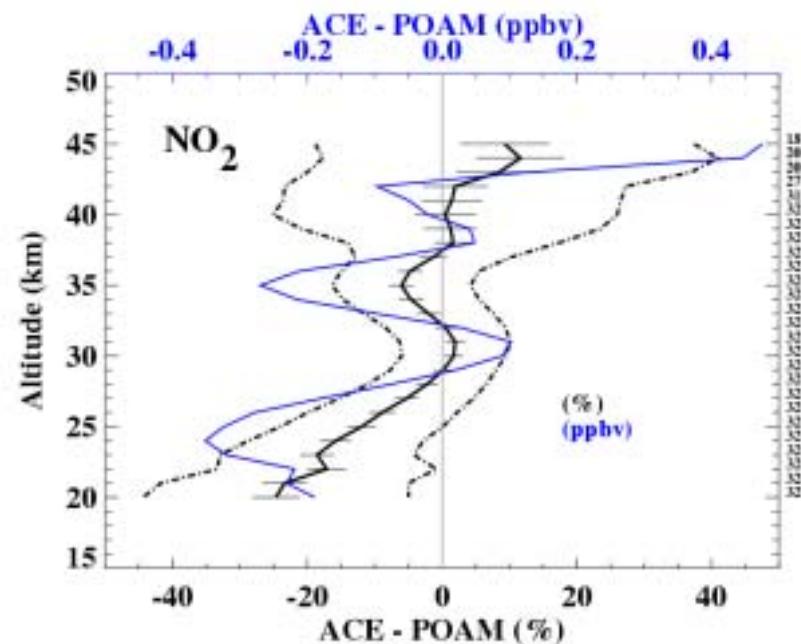
# Comparisons between ACE-FTS and POAM III NO<sub>2</sub>

32 local sunset coincidences from 16-22 March near 67°N

## Average Profiles



## Average Differences





# Next Tasks

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- Automation of retrievals
- Retrievals of atmospheric extinction from imagers
- Further “pre-comparisons” – SAGE, HALOE, GOMOS
- Start of the Validation Program



# ACE Participants

## Mission Scientist

- Peter Bernath, University of Waterloo

## MAESTRO Principal Investigator

- Tom McElroy, MSC

## Instrument Test

- Jim Drummond, University of Toronto

## ACE Instrument Support (FTS, MAESTRO, Imagers)

- Pierre Tremblay, Université Laval
- Jim Drummond, University of Toronto
- David Turnbull, University of Western Ontario

## Science Operations Center, University of Waterloo

- Mike Butler, Manager
- Chris Boone, ACE Scientist
- Sean McLeod, Computer Support
- Kaley Walker, Cal/Val
- Debbie Loney, Admin. Assistant

## Additional Canadian University Participants

- Wayne F. J. Evans, Trent University
- Ian Folkins, Dalhousie University
- Ted Llewellyn, University of Saskatchewan
- Bob Lowe, University of Western Ontario
- Ian McDade, York University
- Jack McConnell, York University
- Diane Michelangeli, York University
- Jim Sloan, University of Waterloo
- Kim Strong, University of Toronto

## ACE-FTS Instrument Contractor, ABB-Bomem

- Marc-Andre Soucy, Project Manager

## Bus Contractor, Bristol Aerospace

- Ian Walkty, Project Manager

## MAESTRO Contractor, EMS / MSC

- Andrew Bell, EMS, Project Manager
- Tom McElroy, MSC, Project Manager

## Main International Partners

### Belgium:

- Reg Colin, Univ. Libre de Bruxelles

### France:

- Claude Camy-Peyret, LPMA CNRS

### USA:

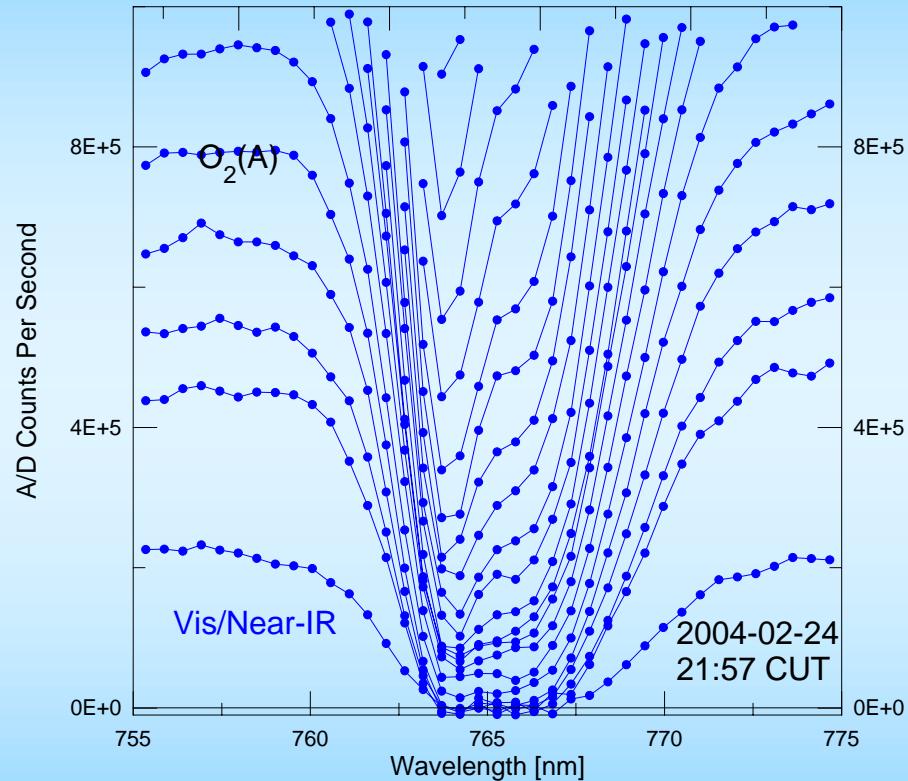
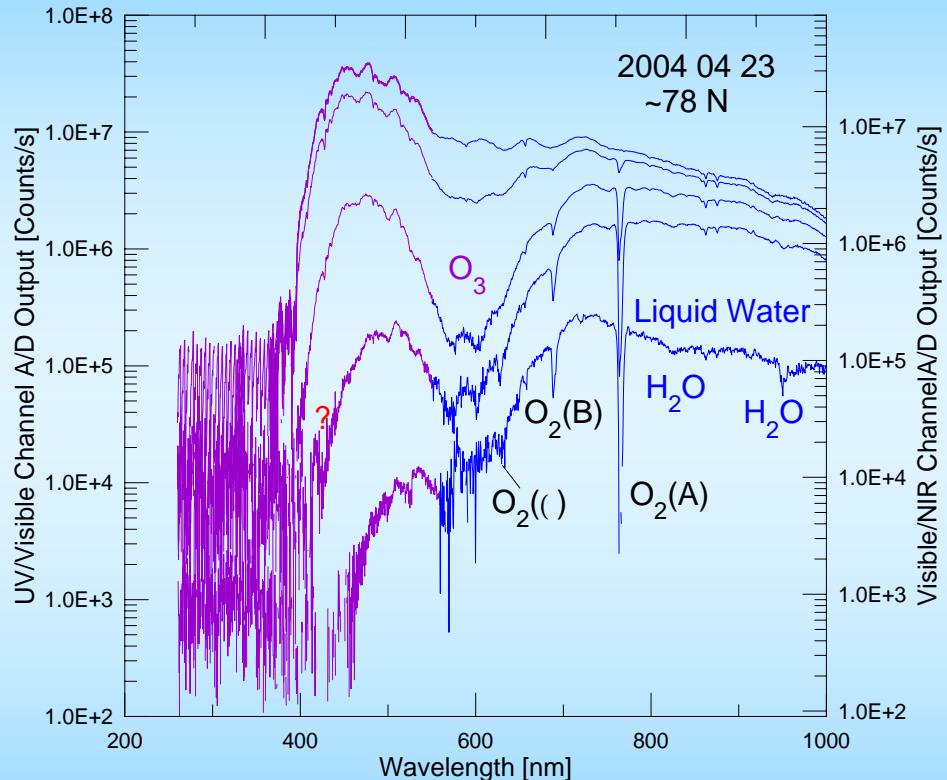
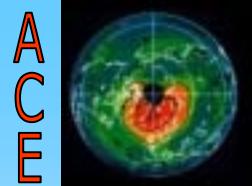
- Curtis Rinsland, NASA Langley

## Canadian Space Agency

- Glen Rumbold, ACE Manager
- Randolph Shelly, Bus
- Victor Wehrle, FTS and Science Team
- Marie Yelle-Whitwan, MAESTRO
- Dennis Ewchuk / Dan Showalter, Ground Segment



# A Few Spectra....





# Backscatter!

